TECHNOLOGY ROUNDUP

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Dies & Punches

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- Electrical, Electronics and Allied Engineering Industrial Exhibition
- First International Conference on Emerging Trends in Science and Technology (ICETST)
- International Conference Innovative Computing Technology
- 21st International Conference on Science and Technology Indicators
- 5th International Conference on Agriculture, Science and Engineering (ICASE2016)
- 2nd International Conference on Engineering, Technology, Management and Science 2016
- Tech Expo North America

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Indigenous Technology

Improved Data Model for Uncertain Data

In recent years, the field of uncertain databases has witnessed a revived interest due to the emergence of a wide range of indirect data gathering methodologies employed in various fields such as sensor data management, moving object management, web data integration, weather forecasting, and economic decision making, etc. RFID (Radio Frequency Identification) systems have become much popular for the identification of moving objects. These methodologies or applications generate large amounts of uncertain data that needs to be managed carefully. It is to be noted that a lot of research for the management of uncertain data has been carried out in the past and it does not study the nature of uncertain data generated as a result of new applications. Thus the broader issue in the field of uncertain databases is to develop a data model (or simply a model) that could provide a mechanism for storage, manipulation and retrieval of uncertain data.

Uncertain data can be categorized as imprecise data and probabilistic data. In each of these categories, the uncertainty can be found at different granularity levels. Conventional data models are developed for the purpose of storing, manipulating and retrieving certain data. These data models do not extend their support for the management of uncertain data. Thus, a standalone data model is required aimed at storing, manipulating and retrieving certain as well as uncertain data. In this research, researchers introduce an uncertain data model for the management of uncertain data along with certain data. Vertical partitioning approach is used to translate an uncertain relation into UDM-relations. This data model supports ALU (Attribute-Level Uncertainty) as well as TLU (Tuple-Level Uncertainty) for the finite sets of possible worlds. It follows the concept of standard relational database technology. With slight modifications to standard relational algebra operators, they have introduced four relational operators that are used to evaluate a query on UDM-relations.

The relational algebraic operators introduced in this research provide a guideline in order to efficiently evaluate a standard relational query on UDM-relations. For future directions, researchers aim to extend their model for probabilistic information and thus develop PUDM, a probabilistic uncertain data model that is a customized data model for probabilistic data.

Courtesy:

Mehran University Research Journal of Engineering & Technology, 2016 Volume 35(1) 84-94
Umar Hayat, Muhammad Usman & Ghani Khan (Department of Computer Science & Engineering, University of Engineering and Technology, Lahore, Pakistan)

www.muet.edu.pk

Indigenous Technology

Nonholonomic Mobile Robot Trajectory Tracking using Hybrid Controller

In recent era, WMR (Wheeled Mobile Robot) has gained attention of the robotic community as it is suitable for a variety of applications including transportation, security and exploration. WMR can be divided into holonomic and non holonomic robot with respect to their mechanical design. Robots whose controllable degree of freedom is equivalent to number of controllable inputs is known as holonomic robot. Whereas, non holonomic robots comprise of less number of controllable inputs, as compare to holonomic robot causing restriction in mobility, therefore it is considered as more challenging problem. Many researchers have worked in this field and proposed various controllers that includes fuzzy logic, adaptive feedback , backstepping, feedback linearization, neural network, sliding mode control and many more. Trajectory tracking can be done by taking information either from leader robot or reference path. When a robot takes a reference path from leader robot this phenomena is called multi-robot formation control.

The purpose of this paper is to provide an innovative controller technique for the feedback controller of the kinematic model of mobile robot. This innovative technique is a hybrid technique comprising of fuzzy Logic and PID known as fuzzy PID controller (F-PID). Moreover, in this technique fuzzy logic is being used as gains tuner of PID.

A control scheme is being presented for the trajectory tracking of a nonholonomic kinematic model of mobile robots. As a kinematic model of mobile robots is nonlinear in nature, therefore, it is controlling is always being a difficult task. Thus, a control hybrid scheme comprises of fuzzy logic and PID (Proportional Integral Derivative) is being proposed, in which adaptive gains of PID controller is being tuned by a fuzzy logic controller. Moreover, the effectiveness of this innovative technique is also proved using the simulations by adding model uncertainties and external disturbances in the system. Besides, the fuzzy logic control system is also being compared by the proposed control system. Results attained show that the fuzzy based PID controller drives improved results than fuzzy logic controller.

Courtesy:

Mehran University Research Journal of Engineering & Technology, 2016 Volume 35(2) 161-170
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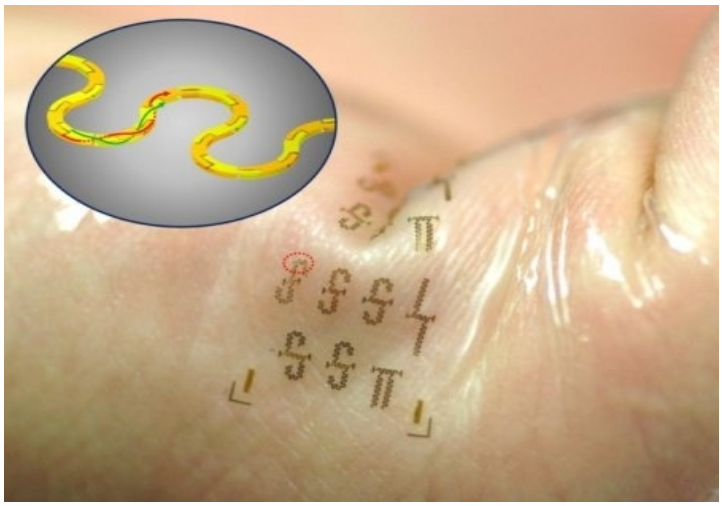
www.muet.edu.pk

Fast, Stretchy Circuits could Yield new Wave of Wearable Electronics

The consumer marketplace is flooded with a lively assortment of smart wearable electronics that do everything from monitoring vital signs, fitness or sun exposure to play music, charge other electronics or even purify the air around all wirelessly. A team of University of Wisconsin-Madison engineers has created the world's fastest stretchable, wearable integrated circuits, an advance that could drive the Internet of things and a much more connected, high-speed wireless world. The team led by Zhenqiang "Jack" Ma, the Lynn H. Matthias Professor in Engineering and Vilas Professor in electrical and computer engineering at UW-Madison, the researchers published details of these powerful, highly efficient integrated circuits in the journal Advanced Functional Materials.



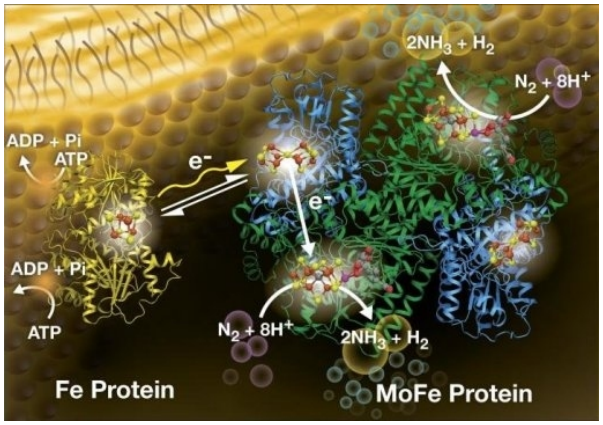
The advance is a platform for manufacturers seeking to expand the capabilities and applications of wearable electronics including those with biomedical applications particularly as they strive to develop devices that take advantage of a new generation of wireless broadband technologies referred to as 5G. With wavelength sizes between a millimeter and a meter, microwave radio frequencies are electromagnetic waves that use frequencies in the .3 gigahertz to 300 gigahertz range. That falls directly in the 5G range. In mobile communications, the wide microwave radio frequencies of 5G networks will accommodate a growing number of cellphone users and notable increases in data speeds and coverage areas. In an intensive care unit, epidermal electronic systems (electronics that adhere to the skin like temporary tattoos) could allow health care staff to monitor patients remotely and wirelessly, increasing patient comfort by decreasing the customary tangle of cables and wires.

What makes the new, stretchable integrated circuits so powerful is their unique structure, inspired by twisted-pair telephone cables. They contain, essentially, two ultra-tiny intertwining power transmission lines in repeating S-curves. This serpentine shape formed in two layers with segmented metal blocks, like a 3-D puzzle gives the transmission lines the ability to stretch without affecting their performance. It also helps shield the lines from outside interference and, at the same time, confine the electromagnetic waves flowing through them, almost completely eliminating current loss. Currently, the researchers' stretchable integrated circuits can operate at radio frequency levels up to 40 gigahertz. And, unlike other stretchable transmission lines, whose widths can approach 640 micrometers (or .64 millimeters), the researchers' new stretchable integrated circuits are just 25 micrometers (or .025 millimeters) thick. That is tiny enough to be highly effective in epidermal electronic systems, among many other applications. Ma's group has been developing what are known as transistor active devices for the past decade. This latest advance marries the researchers' expertise in both high-frequency and flexible electronics. Researchers found a way to integrate high-frequency active transistors into a useful circuit that can be wireless. This opens the door to lots of new capabilities.

www.wisc.edu

Light Driven process that could Revolutionize Agriculture, Food Supply challenge

All living things require nitrogen for survival, but the world depends on only two known processes to break nitrogen's ultra-strong bonds to allow conversion to a form humans, animals and plants can consume. One is a natural, bacterial process on which farmers have relied since the dawn of agriculture. The other is the century-old



Haber-Bösch process, which revolutionized fertilizer production and spurred unprecedented growth of the global food supply. According to Utah State University biochemist Lance Seefeldt, we live in a sea of nitrogen, yet our bodies can't access it from the air, instead, we get this life-sustaining compound from protein in our food.

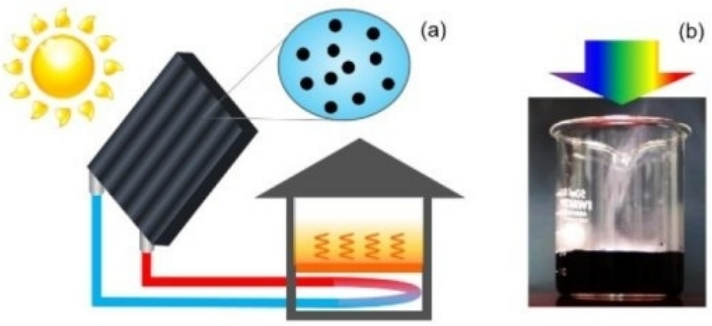
But now, Seefeldt and colleagues announce a light-driven process that could, once again, revolutionize agriculture, while reducing the world food supply's dependence on fossil fuels and relieving Haber-Bösch's heavy carbon footprint. The research team, includes USU's Seefeldt, Derek Harris, Andrew Rasmussen and Nimesh Khadka; Katherine A. Brown and Paul W. King of Colorado's National Renewable Energy Laboratory; Molly Wilker, Hayden Hamby and Gordana Dukovic of the University of Colorado and Stephen Keable and John Peters of Montana State University. The research demonstrates photochemical energy can replace adenosine triphosphate, which is typically used to convert dinitrogen, the form of nitrogen found in the air, to ammonia, a main ingredient of commercially produced fertilizers.

Nitrogen fixation is an energy-intensive process. The Haber-Bösch process currently consumes about two percent of the world's fossil fuel supply, so, the new process, which uses nanomaterials to capture light energy, could be a game-changer. Using light directly to create a catalyst is much more energy efficient. This new ammonia-producing process is the first example of how light energy can be directly coupled to dinitrogen reduction, meaning sunlight or artificial light can power the reaction. Energy-efficient production of ammonia holds promise not only for food production, but also for development of technologies that enable use of environmentally cleaner alternative fuels, including improved fuel cells to store solar energy. In addition to its practical applications, the research sheds light on fundamental aspects of how bacterial enzymes known as nitrogenases function; an area of chemistry Seefeldt has studied for nearly two decades. The research at USU is supported by the U.S. Department of Energy.

www.usu.edu

Solar Water Heating with Nanoparticles

A research team in Japan discovered through numerical calculations that nanoparticles of transition metal nitrides and carbides absorb sunlight very efficiently, and confirmed experimentally that nitride nanoparticles, when dispersed in water, quickly raise water temperature. A research team of Satoshi Ishii, MANA scientist, and Tadaaki Nagao, group leader, Nano-System Photonics Group, International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), discovered through numerical calculations that nanoparticles of transition metal nitrides and carbides absorb sunlight very efficiently, and confirmed experimentally that nitride nanoparticles, when dispersed in water, quickly raise water temperature. These nanoparticles may be applied for heating and distillation of water through efficient sunlight use. Sunlight is one of the most promising renewable energies.



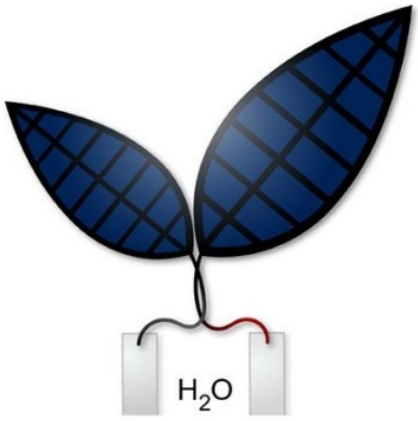
The examples of sunlight use are power generation using solar cells and water heating through photothermal conversion, a process in which absorbed sunlight is converted into heat. Water and air heating accounts for 55% of household energy consumption. If sunlight can be converted into heat very efficiently, it is possible to heat water and air without using electricity, leading to reduction of carbon dioxide emissions. Absorption of sunlight using conventional solar heat collector panels and heat collector tubes results in loss of heat through conduction. For this reason, nanoparticles that can directly heat media including water when they are dispersed in the media are attracting attention.

Recently, the research team jointly performed first-principles calculations to search for nanoparticle materials suitable for photothermal conversion and to estimate their physical properties. As a result, the team found that transition metal nitrides and carbides, which are ceramics, very efficiently absorb sunlight. Furthermore, after choosing titanium nitride (TiN) out of a number of transition metal nitrides, the team dispersed TiN nanoparticles in water, and applied sunlight to the aqueous solution. In this experiment, the team confirmed that the nanoparticles converted sunlight into heat at high efficiency of nearly 90%. Since TiN nanoparticles exhibit broadband plasmon resonances, their sunlight absorption efficiency is likely to be higher than those of gold and carbon nanoparticles on a per nanoparticle basis. In future studies, the team is planning to apply these results to floor heating, water heating, and distillation of sewage and seawater. Besides these projects, the team is also working on other applications of nanoparticles such as the development of hybrid materials between polymers and nanoparticles and the study of nanoparticle-mediated chemical reactions.

www.nims.go.jp

Bionic Leaf Turns Sunlight into Liquid Fuel

The days of drilling into the ground in the search for fuel may be numbered. Nocera, the Patterson Rockwood Professor of Energy at Harvard University, and Pamela Silver, the Elliott T. and Onie H. Adams Professor of Biochemistry and Systems Biology at Harvard Medical School, have co-created a system that uses solar energy to split water molecules and hydrogen-eating bacteria to produce liquid fuels. This is a true artificial photosynthesis system, before, people were using artificial photosynthesis for water-splitting, but this is a true A-to-Z system, and researchers have gone well over the efficiency of photosynthesis in nature. While the study shows the system can be used to generate usable fuels, its potential does not end there.



According to researcher the beauty of biology is it's the world's greatest chemist, biology can do chemistry we cannot do easily. In principle, we have a platform that can make any downstream carbon-based molecule. So this has the potential to be incredibly versatile. Dubbed "bionic leaf 2.0," the new system builds on previous work by Nocera, Silver and others, though it was capable of using solar energy to make isopropanol yet faced a number of challenges. The main challenge was the fact that the catalyst used to produce hydrogen -- a nickel-molybdenum-zinc alloy -- also created reactive oxygen species, molecules that attacked and destroyed the bacteria's DNA. To avoid that problem, researchers were forced to run the system at abnormally high voltages, resulting in reduced efficiency.

Now they designed a new cobalt-phosphorus alloy catalyst, which does not make reactive oxygen species, allowed to lower the voltage, and led to a dramatic increase in efficiency. The system can now convert solar energy to biomass with 10 percent efficiency, far above the one percent seen in the fastest growing plants.

In addition to increasing the efficiency, Nocera and colleagues were able to expand the portfolio of the system to include isobutanol and isopentanol. Researchers also used the system to create PHB, a bio-plastic precursor, a process first demonstrated by MIT professor Anthony Sinskey. The new catalyst also came with another advantage -- its chemical design allows it to "self-heal" meaning it wouldn't leech material into solution.

These catalysts are totally biologically compatible. Though there may yet be room for additional increases in efficiency, Nocera said the system is already effective enough to consider possible commercial applications but within a different model for technology translation. It is an important discovery--it can do better than photosynthesis. In many ways, the new system marks the fulfillment of the promise of his "artificial leaf" -- which used solar power to split water and make hydrogen fuel.

www.harvard.edu

High-Tech Librarian Knows its Books

Automated robot that scans library shelves using laser mapping and radio tags can ensure no book is misplaced again. Being able to access and download information in an instant is a hallmark of the digital age. But much of the world's knowledge remains between the pages of printed books. Tracking these volumes in libraries is a tedious, labor-intensive process, but improved access to these invaluable resources is now possible. Some libraries are adapting to automation by placing Radio Frequency Identification (RFID) tags into their collections. These computerized barcodes contain unique identifying labels that can be quickly scanned using wireless, handheld RFID readers. Alternatively, 'smart shelves' containing multiple RFID antenna can automatically register when books enter or are removed from their stacks. Such approaches are expensive, however, and still rely on manual labor.

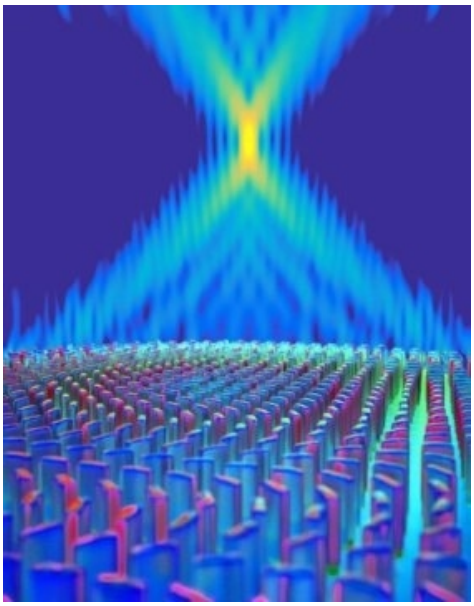
At A*STAR's Institute for Infocomm Research, Singapore, researchers Renjun Li, Zhiyong Huang, Ernest Kurniawan, and Chin Keong Ho are designing robots that can relieve librarians of many menial tasks, while enhancing searching and sorting of books. Their latest project is an autonomous robotic shelf scanning (AuRoSS) platform that can self-navigate through libraries at night, scanning RFID tags to produce reports on missing and out-of-sequence books. Li notes that this function required a way to steer a tall, wheeled robot through complex mazes of library stacks, while keeping a critical distance from shelves at all times. To help track shelves in real-time, the researchers assembled a 'macro-mini' manipulator, where the mobile base robot contains an additional small robotic arm. The mini manipulator can move laterally, and uses ultrasonic sensors to position an RFID antenna to the optimal distance for book scanning. It also measures positioning errors, and feeds this data into the mobile navigation unit to anticipate direction changes.

Real-world trials at Singapore libraries revealed the AuRoSS robot's potential up to 99 per cent scanning accuracy was achieved, even with curved shelves. "During the re-opening of Pasir Ris Public Library, they put on a public demonstration and received very positive reactions," says Li. Researchers are improving the robustness and analytics engine and integrating into library operations. The A*STAR-affiliated researchers contributing to this research are from the Institute for Infocomm Research.

www.a-star.edu.sg

Meta-Lens Works in the Visible Spectrum, sees smaller than a Wavelength of Light

Researchers from the Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS) have demonstrated the first planar lens that works with high efficiency within the visible spectrum of light covering the whole range of colors from red to blue. The lens can resolve nanoscale features separated by distances smaller than the wavelength of light. It uses an ultrathin array of tiny waveguides, known as a metasurface, which bends light as it passes through, similar to a curved lens. This technology is potentially revolutionary because it works in the visible spectrum, which means it has the capacity to replace lenses in all kinds of devices, from microscopes to camera, to displays and cell phones, In the near future, metalenses will be manufactured on a large scale at a small fraction of the cost of conventional lenses, using the foundries that mass produce microprocessors and memory chips.



Correcting for chromatic spread over the visible spectrum in an efficient way, with a single flat optical element, was until now out of reach. The Capasso group's metalens developments enable the integration of broadband imaging systems in a very compact form, allowing for next generations of optical sub-systems addressing effectively stringent weight, size, power and cost issues, such as the ones required for high performance AR/VR wearable displays." In order to focus red, blue and green light -- light in the visible spectrum, the team needed a material that would not absorb or scatter light. Researchers needed a material that would strongly confine light with a high refractive index and in order for this technology to be scalable; they needed a material already used in industry.

The team used titanium dioxide, a ubiquitous material found in everything from paint to sunscreen, to create the nanoscale array of smooth and high-aspect ratio nanostructures that form the heart of the metalens. They wanted to design a single planar lens with a high numerical aperture, meaning it can focus light into a spot smaller than the wavelength. The more tightly you can focus light, the smaller your focal spot can be which potentially enhances the resolution of the image. The team designed the array to resolve a structure smaller than a wavelength of light, around 400 nanometers across. At these scales, the metalens could provide better focus than a state-of-the art commercial lens. Normal lenses have to be precisely polished by hand. Any kind of deviation in the curvature, any error during assembling makes the performance of the lens go way down. Their lens can be produced in a single step -- one layer of lithography and they have a high performance lens, with everything where you need it to be.

The amazing field of metamaterials brought up lots of new ideas but few real-life applications have come so far. The Capasso group with their technology-driven approach is making a difference in that regard. This new breakthrough solves one of the most basic and important challenges, making a visible-range meta-lens that satisfies the demands for high numerical aperture and high efficiency simultaneously, which is normally hard to achieve. One of the most exciting potential applications, is in wearable optics such as virtual reality and augmented reality. Any good imaging system right now is heavy because the thick lenses have to be stacked on top of each other. No one wants to wear a heavy helmet for a couple of hours. This technique reduces weight and volume and shrinks lenses thinner than a sheet of paper. Imagine the possibilities for wearable optics, flexible contact lenses or telescopes in space. The authors have filed patents and are actively pursuing commercial opportunities.

www.seas.harvard.edu

Forthcoming Tech Events

National

56th International Conference on Nanoscience, Nanotechnology and Advanced Materials IC2NM
23-24 July, 2016 Rawalpindi

Electrical, Electronics and Allied Engineering Industrial Exhibition
2-4 August 2016
Expo Center Karachi

First International Conference on Emerging Trends in Science and Technology (ICETST)
6-10 September, 2016
Pearl Continental Hotel Rawalpindi
www.fjwu.edu.pk

International Conference On Innovative Computing Technology
22-24, November 2016
Bahawalpur, Pakistan
www.intech-bahawalpur

International Events

21st International Conference on Science and Technology Indicators
14-16 September 2016
Valencia Spain
www.sti2016.org

5th International Conference on Agriculture, Science and Engineering (ICASE2016)
26-29 September 2016
Abuja Nigeria
www.iatel.net

2nd International Conference on Engineering, Technology, Management and Science 2016
5-6 October, 2016
Dubai, United Arab Emirates
www.iotevents.org

Tech Expo North America
20-21, October 2016
Santa Clara, United States
www.iotevents.org

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